CLAIMS

What is claimed is:

1. A method for minimizing precipitation of developing reactant by lowering a sudden change in pH, said method comprising:

developing at least a portion of a polymer layer on a substrate with a charge of developer fluid; then

permitting at least a portion of said charge of developer fluid to dwell on said polymer so as to controllably minimize a subsequent sudden change in pH; and then

rinsing said polymer with a charge of another fluid.

2. The method of claim 1, further comprising spinning said substrate at an angular velocity sufficient to remove a portion of said developer fluid from said substrate.

3. The method of claim 2, wherein spinning said substrate includes spinning said substrate at an angular velocity, and for a duration, sufficient to remove a majority of said developer fluid.

4. The method of claim 1, wherein developing at least said portion of said polymer on said substrate includes developing at least a portion of an exposed photoresist polymer on said substrate.

5. The method of claim 1, wherein developing at least said portion of said polymer on said substrate includes developing said at least a portion of said polymer on a semiconductor wafer substrate.

6. The method of claim 1, wherein rinsing said polymer with said charge of another fluid includes rinsing said polymer with deionized water.

7. The method of claim 1, further comprising providing a laminar airflow field in a developer fluid module in which said substrate is located.

8. A method for minimizing precipitation of developing reactant by lowering a sudden change in pH, said method comprising:

developing at least a portion of a polymer layer on a substrate with an initial charge of a developer fluid; then

rinsing said polymer with an additional charge of said developer fluid so as to controllably minimize a subsequent sudden change in pH; and then

rinsing said polymer with a charge of another fluid.

9. The method of claim 8, wherein developing at least said portion of said polymer on said substrate includes developing at least a portion of an exposed photoresist polymer on said substrate.

10. The method of claim 8, wherein developing at least said portion of said polymer on said substrate includes developing said at least a portion of said polymer on a semiconductor wafer substrate.

11. The method of claim 8, wherein rinsing said polymer with said charge of another fluid includes rinsing said polymer with deionized water.

12. The method of claim 8, further comprising providing a laminar airflow field in a developer fluid module in which said substrate is located.

13. A method for minimizing precipitation of developing reactant by lowering a sudden change in pH, said method comprising:

developing at least a portion of a polymer layer on a substrate with a charge of developer fluid; then

contacting said substrate with a charge of buffer, thereby mixing at least a portion of said developer fluid with at least a portion of said charge of buffer, so as to controllably minimize a subsequent sudden change in pH; and then

rinsing said polymer with a charge of another fluid.

14. The method of claim 13, wherein developing at least said portion of said polymer on said substrate includes developing at least a portion of an exposed photoresist polymer on said substrate.

15. The method of claim 13, wherein developing at least said portion of said polymer on said substrate includes developing said at least a portion of said polymer on a semiconductor wafer substrate.

16. The method of claim 13, wherein rinsing said polymer with said charge of another fluid includes rinsing said polymer with deionized water.

17. The method of claim 13, further comprising providing a laminar airflow field in a developer fluid module in which said substrate is located.

18. An apparatus for minimizing fluid impingement force on a polymer layer to be developed on a substrate, thereby improving yield and line width control performance, said apparatus comprising:

a nozzle including:

a manifold adapted to supply a fluid;

a plurality of fluid conduits coupled to said manifold; and

a plurality of tubular inserts located within said plurality of fluid conduits.

19. The apparatus of claim 18, wherein said plurality of tubular inserts are externally extended beyond a bottom of said nozzle.

20. The apparatus of claim 18, wherein said plurality of tubular inserts are internally extended into said fluid manifold so as to define a reservoir adapted to maintain a substantially equivalent static pressure with regard to said plurality of fluid conduits.

21. The apparatus of claim 18, wherein said plurality of fluid conduits are aligned to define an axis.

22. The apparatus of claim 21, wherein said nozzle is connected to a bracket adapted to raise and lower multiport nozzle with regard to said substrate and reposition said axis so as to be substantially coplanar with a normal to a center of said substrate.

23. The apparatus of claim 21, wherein said rinse axis is as long as a radius of said substrate.

24. The apparatus of claim 18, further comprising a chamber coupled to said nozzle, and said chamber adapted to provide a laminar airflow field.

25. The apparatus of claim 18, wherein said nozzle includes another manifold.

26. The apparatus of claim 25, wherein said fluid manifolds and said another manifold are staggered so as to reduce an external width of said nozzle compared to a nominal external width of said nozzle achievable without either intersecting said fluid manifold and said another manifold or staggering said fluid manifold and said another manifold.

27. An apparatus for minimizing fluid impingement force on a polymer layer to be developed on a substrate, thereby improving yield and line width control performance, said apparatus comprising:

a nozzle including:

a developer manifold adapted to supply a developer fluid;

a plurality of developer fluid conduits coupled to said developer manifold;

a rinse manifold adapted to supply a rinse fluid; and

a plurality of rinse fluid conduits coupled to said developer manifold,

wherein said developer manifold and said rinse manifold are staggered so as to reduce an external width of said nozzle compared to a nominal external width of said nozzle achievable without either intersecting said fluid manifold and said another manifold or staggering said fluid manifold and said another manifold.

28. The apparatus of claim 27, further comprising a plurality of tubular inserts located within at least one of i) said plurality of developer fluid conduits and ii) said plurality of rinse fluid conduits.

29. The apparatus of claim 28, wherein said plurality of tubular inserts are externally extended beyond a bottom of said nozzle.

30. The apparatus of claim 28 wherein said plurality of tubular inserts are internally extended into said fluid manifold so as to define a reservoir adapted to maintain a substantially equivalent static pressure with regard to said plurality of fluid conduits.

31. The apparatus of claim 27, wherein said plurality of fluid conduits are aligned to define an axis.

32. The apparatus of claim 27, wherein said nozzle is connected to a bracket adapted to raise and lower multiport nozzle with regard to said substrate and reposition said axis so as to be substantially coplanar with a normal to a center of said substrate.

33. The apparatus of claim 27, wherein said rinse axis is as long as a radius of said substrate.

34. The apparatus of claim 27, further comprising a chamber coupled to said nozzle, and said chamber adapted to provide a laminar airflow field.

35. An apparatus for minimizing fluid impingement force on a polymer layer to be developed on a substrate, thereby improving yield and line width control performance, said apparatus comprising:

a nozzle including:

a developer manifold adapted to supply a developer fluid;

a plurality of developer fluid orifices coupled to said developer manifold;

a rinse manifold adapted to supply a rinse fluid;

a plurality of rinse fluid orifices coupled to said rinse manifold, and said plurality of rinse fluid orifices arranged to define a rinse fluid axis,

wherein said nozzle is connected to a bracket adapted to raise and lower said nozzle with regard to said substrate and reposition said at least

one rinse axis so as to be substantially coplanar with a normal to a center of said substrate.

36. The apparatus of claim 35, wherein said developer manifold and said rinse manifold are staggered so as to reduce an external width of said nozzle compared to a nominal external width of said nozzle achievable without either intersecting said fluid manifold and said another manifold or staggering said fluid manifold and said another manifold

37. The apparatus of claim 35, further comprising a plurality of tubular inserts located within at least one of i) said plurality of developer fluid conduits and ii) said plurality of rinse fluid conduits.

38. The apparatus of claim 37, wherein said plurality of tubular inserts are externally extended beyond a bottom of said nozzle.

39. The apparatus of claim 37, wherein said plurality of tubular inserts are internally extended into said fluid manifold so as to define a reservoir adapted to maintain a substantially equivalent static pressure with regard to said plurality of fluid conduits.

40. The apparatus of claim 35, wherein said rinse axis is as long as a radius of said substrate.

41. The apparatus of claim 35, further comprising a chamber coupled to said nozzle, and said chamber adapted to provide a laminar airflow field.

42. The apparatus of claim 35, wherein said plurality of developer fluid orifices define a developer fluid axis and said developer fluid axis is substantially coplanar with said rinse axis.

43. The apparatus of claim 42, wherein said at least one developer fluid axis is substantially parallel to said at least one rinse axis.